

Model & Environment functionalities

Table 1 gathers i) model scientific functionalities, ii) model technical features, iii) model environment (forcing data, post processing tools), iv) support material and v) reference simulations that could be used by the whole ORCHIDEE group. It provides for each component (if relevant):

- a key reference,
- the name of the current ORCHIDEE versions that contain the described features,
- the main contact points: 1 or 2 persons to be contacted if you plan to use the component (at least one person should be still 'active' in the ORCHIDEE group),
- the list of direct contributors to that component,
- the status of the component which could be: "free to use", "restricted (contact needed)", "not available yet", or any other condition.

Note that to respect a fair use policy, any scientific/technical component should after a certain time or number of publications become "free to use".

Any user that will benefit from one of these components for a paper, to respect the fair use policy should, depending on the status of the component:

- contact the main responsible for permission of use;
- agree with the main responsible on the level of reward (acknowledgement, co-authorship of one or few contributors,...);
- in case of any conflict the responsible or the user should report to the ORCHIDEE group;
- consider the references that are listed in the table for proper citation of the component.

Table 1: Model and Environment functionalities of ORCHIDEE

FUNCTIONALITY	REFERENCES	ORC Version	MAIN CONTACT PERSONS	CONTRIBUTORS	STATUS (from restricted to free)
Energy					
New soil temperature and hydrology discretization	Wang et al., 2016	TRUNK	Frederic Cheruy, Fuxing Wang,	Agnes Ducharne, Jean Louis Dufresne, Jan Polcher	free
Soil freezing	Gouttevin et al. 2012	TRUNK ORC-MI CT	Gerhard Krinner	Isabelle Gouttevin, Philippe Ciais	free
Permafrost carbon diffusion below active layer and inhibited low-T decomposition	Koven et al. 2011	ORC-MI CT	Philippe Ciais	Tao Wang, Shushi Peng, Gerhard Krinner F. Maignan	Contact developers
Multi-layer energy budget	Ryder et al 2014 Naudts et al 2014	ORC-CA N	Sebastiaan Luysaert,	James Ryder, Philippe Peylin,	Contact developers

			Jan Polcher	Catherine Ottlé, Yiying Chen	rs
Hydrologie					
Multi-layer soil hydrology	de Rosnay 1999 de Rosnay et al. 2000, 2002 d'Orgeval 2006 d'Orgeval et al. 2008 Campoy et al. 2013	TRUNK ORC-CAN ORC-MICT	Agnès Ducharne, Jan Polcher	Patricia de Rosnay, Tristan d'Orgeval, Martial Mancip, Matthieu Guimberteau, Aurélien Campoy, Frédérique Cheruy, Fuxing Wang, Josefine Ghattas	free
Debugged and simplified and multi-layer soil hydrology fully compatible with soil freezing	Ducharne et al. in prep for special issue	TRUNK ORC-MICT	Agnès Ducharne	Same as above +Isabelle Gouttevin, Pascal Maugis, Catherine Ottlé, Fabienne Maignan	Contact Agnès Ducharne
Routing	Vivant 2002 Polcher 2003 de Rosnay et al. 2003 Ngo-Duc 2005 Ngo-Duc et al. 2007 d'Orgeval et al. 2008 Guimberteau 2012 Guimberteau et al. 2012a, 2012b	TRUNK	Jan Polcher, Matthieu Guimberteau	Anne-Charlotte Vivant, Patricia de Rosnay, Thanh Ngo-Duc, Tristan d'Orgeval, Agnès Ducharne	Contact develope rs
New snow multi-layer module	Wang et al. 2013	TRUNK ORC-MICT	Tao Wang, Catherine Ottlé	Philippe Ciais, Aaron Boone, Jan Polcher	Contact develope rs
Module with soil organic C effect on soil temperature	Koven et al. 2011	ORC-MICT	Shushi Peng	Philippe Ciais F. Maignan	Contact develope rs
Peatland hydrology and CH4 emissions		to be introduced in ORC-MICT	Chloé LARGERON	Gerhard Krinner Philippe Ciais	Contact develope rs

Photosynthesis & Vegetation Carbon - Nitrogen Cycle					
New photosynthesis scheme – Analytical solution		TRUNK ORC-CAN	Nicolas Vuichard	Thomas Eglin	Contact developers
Two way radiation transfer model for albedo	Otto et al 2014, Naudts et al 2014, McGrath et al 2014	ORC-CAN	Sebastiaan Luysaert	Juliane Otto, James Ryder, Kim Naudts, Matt McGrath, Aude Valade, Yiying Chen	Contact developers
Hydraulic architecture of plants	Naudts et al 2014	ORC-CAN	Sebastiaan Luysaert	Juliane Otto, James Ryder, Kim Naudts, Matt McGrath, Aude Valade, Yiying Chen	Contact developers
Allometric based Carbon allocation	Naudts et al 2014	ORC-CAN	Sebastiaan Luysaert	Juliane Otto, James Ryder, Kim Naudts, Matt McGrath, Aude Valade, Yiying Chen	Contact developers
Forest management	Bellassen et al 2010 and Naudts et al 2014	ORC-CAN ORC-FM	Sebastiaan Luysaert	Juliane Otto, James Ryder, Kim Naudts, Matt McGrath, Aude Valade, Yiying Chen	Contact developers
Age classes	Naudts et al 2014	ORC-CAN	Sebastiaan Luysaert	Juliane Otto, James Ryder, Kim Naudts, Matt McGrath, Aude Valade, Yiying Chen	Contact developers
High latitude DGVM	Zhu et al. 2014	ORC-MICT	Dan Zhu	Nicolas Viovy, Shushi Peng, Philippe Ciais	Contact developers
Nitrogen cycle		TRUNK	Nicolas Vuichard	Nicolas Vuichard, ???	Contact developers
Fluorescence		ORCHI DEE-CAN	Fabienne Maignan	Cédric Bacour, Natasha MacBean, Philippe Peylin	Contact developers
Yedoma carbon formation by accumulation	Zhu et al. 2015	ORC-MICT	Dan Zhu	Shushi Peng, Philippe Ciais, Nicolas Viovy	Contact developers
Soil Organic Matter					

Vertical soil carbon profile	Camino Serrano et al., In prep	SOM	Bertrand Guenet	Marta Camino Serrano, Bertrand Guenet	Contact developers
DOC in soil	Camino Serrano et al., In prep	SOM	Bertrand Guenet	Marta Camino Serrano, Bertrand Guenet	Contact developers
Priming effect	Guenet et al. 2013	SOM	Bertrand Guenet	Bertrand Guenet	Contact developers
DOC in rivers. River routing scheme enhanced for DOC transport and decomposition, including CO2 emissions from aquatic systems	Lauerwald et al., In prep	ORCHI-DOC	Ronny Lauerwald	Bertrand Guenet Philippe Ciais Pierre Regnier Marta Camino	Contact developers
Module with soil organic C vertical profiles inclusive of bioturbation in non frozen soils		ORC-MICT	Dan Zhu F Maignan	Philippe Ciais Bertrand Guenet	Contact developers
Frozen soil C decomposition module with CH4 and CO2 production and diffusion	Khvorostyanov et al. 2009ab	ORC-MICT	Philippe Ciais	Shushi Peng G. Krinner D. Khvorostyanov G.	Contact developers
FIRES - Land Use - Vegetation Dynamic					
Fire (SPITFIRE)		Soon in the TRUNC	Chao Yue, Patricia Cadule	Philippe Ciais	
ORC-SPITFIRE interactive with DGVM, calibrated fire spread and fuel module, variable lightning based ignitions		ORC-MICT	Chao Yue	Philippe Ciais	Contact developers
Gross land use change with PFT cohorts and age classes		ORC-MICT	Chao Yue	Philippe Ciais	Contact developers
Deforestation fire		ORC-MI	Chao Yue	Philippe Ciais	Contact

module combined with land use change		CT			develope rs
Vegetation Dynamic for high latitudes	Zhu et al. 2014	ORC-MI CT	Philippe Ciais, Nicolas Viovy	Dan Zhu, Sushi Peng	Contact develope rs
Grassland Management					
Grassland management Europe		ORC-G M-EU	Jinfeng Chang Nicolas Viovy	Philippe Ciais Nicolas Vuichard,	Free
Grassland management - Global with calibrated global management module 1901-2012, C4 pasture calibration, simplified N effect on GPP, soil moisture dependent grazing, grazers metabolic energy variable, N enhanced GPP, Ndeposition and fertilization drivers		ORC-G M-GLO B	Jinfeng Chang	Philippe Ciais Nicolas Viovy	Contact develope rs
Wild grazers interactions with grassland ecosystems		ORC-MI CT	Dan Zhu	Jinfeng Chang Philippe Ciais Shushi Peng	
Cropland management					
Crop from STICS tested at sites in Western Europe		ORC-CR OP	Nicolas Vuichard, Philippe Ciais	Xuichen Wu, Xuhui Wang, Nicolas Viovy, Nathalie DeNoblet	Contact develope rs
Crop model tested and calibrated globally for maize and wheat, including three rice types, soy, new irrigation module, allocation module, rotations,		ORC-CR OP-GLO B	Xuhui Wang	Philippe Ciais Nicolas Viovy	Contact develope rs

soil tiles per crop type					
Additional Cycles / Compounds					
Wetlands (topmodel calibrated to 11-layer hydrology and rewritten CH4 emission model)	ORC-MICT	ORC-MICT	Shushi Peng	Philippe Ciais	Contact developers
Peatland hydrology and CH4 emissions		to be introduced in ORC-MICT	Chloé LARGERON	Gerhard Krinner Philippe Ciais	Contact developers
Dynamic peat (peat carbon formation and decomposition coupled with topmodel)		to be introduced in ORC-MICT	Chunjing Qiu	Philippe Ciais Dan Zhu	Contact developers
Phosphorus cycle and its interaction with the N and C cycles		ORCE-C N-P	Daniel Goll	Daniel Goll Shushi Peng Philippe Ciais Fabienne Maignan, Nicolas Vuichard, Shushi Peng Albert Jornet & IMBALANCE-P team	Contact developers
Emissions of volatile organic compounds from vegetation - Extended scheme with new species	Messina et al., ACPD, 2016	TRUNK	Palmira Messina, Juliette Lathière		Contact developers
Technical features ; model drivers ; associated tools					
Externalization		TRUNK ORC-CAN ORC-MICT	Nicolas Vuichard	Didier Solyga, Nicolas Viovy and Philippe Peylin	Free to use
Advanced technical features (MPI, OpenMP, XIOS,...)		TRUNK	Josefine Ghattas	Anne Cosic, Yann Meurdesoif, Josefine Ghattas	Free to use

Forcing: CRU-NCEP		ALL	Nicolas Viovy	Nicolas Viovy	Contact developers
Forcing: formatting for standard version and coarser resolutions		ALL	Fabienne Maignan	Chao Yue, Jan Polcher, Matthieu Guimberteau	Contact developers
Code derivation and adjointisation		TRUNK	Pascal Maugis, Philippe Peylin	Frederic Chevallier, Cedric Bacour,	Contact developers
Model parameter sensitivity analysis code	Dantec-Nédélec et al.,	TRUNK	Catherine Ottlé	Cyril Andre, Rihab	Contact developers
Data Assimilation system with ORCHIDEE (code for parameter optimization using Variational / Monte Carlo Algorithm)	Peylin et al. or other more appropriated	ALL	Philippe Peylin,	Cedric Bacour, Natasha MacBean, Vladislav Bastrikov, Catherine Otle	Contact developers
Simulation & post-processing Tools		ALL	Josefine Ghattas	Sebastien Denvil, Fabienne Maignan, Josefine Ghattas,	
Validation chain with FluxNet data		ALL	Nicolas Vuichard		Contact developers
Forest management reconstruction	McGrath et al 2015	ORCHIDEE-CAN	Sebastian Luysaert	Juliane Otto, James Ryder, Kim Naudts, Matt McGrath, Aude Valade, Yiyang Chen	Contact developers
Grassland management global reconstruction	Chang et al. 2016	ORC-GM-GLOB	Jinfeng Chang	Philippe Ciais Nicolas Viovy Mario Herrero	Contact developers
Mineral N fertilizer distribution downscaled and for different crop types	Parkes et al. 2015	ORC-CROP-GLOB	Ben Parkes Xuhui Wang	Philippe Ciais Benjamin Sultan	Contact developers
PFT reconstruction constrained by historical forest area and LUH v1 and Pongratz et al. 1500-2012	Peng et al. 2016	TRUNK	Shushi Peng	Philippe Ciais Fabienne Maignan	Free

Model simulations					
Reference simulations: Trendy, MsTMIP, ISI-MIP2.1A		TRUNK	Fabienne Maignan, Nicolas Viovy, Jinfeng Chang	Fabienne Maignan, Josefine Ghattas, Nicolas Vuichard, Nicolas Viovy, Shushi Peng, Philippe Ciais, Jinfeng Chang	Free to use ? subject to data policy of intercomparison programs